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December 23, 1988

Dear Manufacturer:

SUBJECT: Draft Cold Temperature Test Procedures

EPA is distributing a draft cold temperature test procedure (Enclosure I) which was developed after conversations with EPA personnel and selected industry representatives with cold temperature emission test experience. We are attempting to develop appropriate test procedures to address the current lack of definition for cold temperature testing. As this is a development process, our approach has been to determine the most technically appropriate procedures which are at least potentially feasible, regardless of the current capability of cold test facilities. We recognize that many manufacturers may not be able to currently comply with every aspect of the proposed test procedures. We, ourselves, cannot comply with all of the measures contained in this proposal. Enclosure II identifies how EPA's current in-house test practice differs from the draft procedure contained in Enclosure I.

We are in the process of revising this draft procedure to determine changes which will improve the technical credibility of the procedure or make it easier or cheaper to conduct without undue risk to data validity and repeatability. Some of the issues we are still working to resolve include:

1. Whether the dynamometer warm-up has a significant effect on emissions and test-to-test variability. Some existing cold test cells cannot comply with the procedure as proposed due to the dual requirements of warming the dynamometer and soaking the vehicle in the test cell prior to the emissions test. The proposed dual requirements would require the use of self-motoring electric dynamometers.
2. Whether it is more important to require a dynamometer warm-up before the emissions test (and, hence, electric dynamometers) or to allow increased flexibility by deleting the dynamometer warm-up.
3. The amount of time which should be allowed after the dynamometer is warmed to start the test, if electric

dynamometers are required. (This is of concern because a stringent requirement of about five minutes may yield more representative vehicle loadings, but may not allow enough time for some test cells or test crews to complete test preparation.)

4. Whether dynamometer speed tolerances should be less stringent (i.e., different from the tolerances currently used at 75 F of +4 mph during the prep and +2 mph during the test) at colder temperatures because of cold vehicle performance.

The enclosed draft procedure is a working document that is still in the development process. We intend to make adjustments to the procedure, keeping in mind that we are trying to work toward high standards of test procedure appropriateness. We would welcome any ideas or information you might wish to share with us. Should you have any comments or questions about the draft procedure, please contact John German (313) 668-4214 of my staff. Comments received before January 27, 1989 would be especially helpful in our test procedure development. If desired, you may also contact Mr. German to arrange a meeting to discuss the proposed procedure or to present comments.

Sincerely,

Robert E. Maxwell, Director  
Certification Division  
Office of Mobile Sources

Enclosures

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ENCLOSURE I

DRAFT PROPOSAL

COLD TEMPERATURE TEST PROCEDURE

INTRODUCTION

The purpose of this proposal is to establish a standardized procedure for emissions testing at colder ambient temperatures.

Once a test procedure is approved, it will be issued as an industry guideline for cold temperature testing. This test procedure is structured similarly to the Federal Test Procedure (FTP), with only certain changes to account for the cold temperature conditions. These changes will be defined, but first a short background on the reasons for establishing a cold temperature test procedure is provided.

## BACKGROUND

As a result of the Cold CO Workshop held in March 1988, EPA learned many organizations are not involved in cold ambient temperature vehicle testing due to a lack of direction. Some of those who have begun testing vehicles under cold temperature conditions were unwilling to share their data until a cold temperature test procedure is defined. In addition, a great deal of concern exists over the comparability of test results achieved using different test procedures. To encourage more groups to test at cold temperatures and to ensure the comparability of the data, a standardized cold temperature test procedure is being developed.

## TEST PROCEDURE SPECIFICATIONS

This cold temperature test procedure basically follows the FTP. Test procedure confirmations and changes from the FTP are listed below.

### I. Vehicle Preparation

#### A. Fuel Exchange

1. Fuel type used shall be the same as specified in 40 CFR 86.113(a)(1) for FTP tests.
2. The vehicle shall be fueled to 40% of primary tank capacity.<sup>1</sup>
3. Fuel temperature specifications are defined in the next section.

1. Fuel drain is not required so long as existing fuel meets the requirements specified in 40 CFR 86.113(a)(1) for FTP tests.

#### B. LA-4 Prep

1. The vehicle fuel system shall be stabilized by:

- a. Soaking the vehicle in the test cell for one hour prior to the prep. The soak temperature (dry bulb) shall be maintained at an average temperature<sup>1</sup> within +5 F of the nominal test temperature with maximum excursions<sup>2</sup> of +10 F from nominal test temperature,  
or
- b. Fueling the vehicle with gasoline chilled to nominal test temperature (+10 F) and placed in a test cell at the test temperature.
2. Cell temperature (dry bulb) shall be at nominal test temperature (+3 F) before the start of the prep cycle.
3. During the prep cycle, the cell temperature shall be maintained at an average temperature within +5 F of the nominal test temperature, with maximum excursions of +10 F from nominal test temperature.
4. Cell temperature shall be measured at the intake of the fixed speed cooling fan.

II. Vehicle Soak (either of the following soaks may be used)

A. Standard Vehicle Soak

1. Soak temperature (dry bulb) shall be maintained at an average temperature within +5 F of the nominal test temperature during each hour of the soak period, with maximum excursions of +10 F from nominal test temperature.
2. Soak time shall be a minimum of 12 hours, maximum of 36 hours.

B. Modified Vehicle Soak

1. Soak temperature need not be controlled, except during the last hour. If the vehicle is soaked in a different area prior to the forced cooldown in the test cell (described in section II.B.2.), the temperature during this soak should be as close to test temperature as practical.

1. For the purpose of calculating the average temperature, the cell temperature shall be sampled at a consistent interval not to exceed 15 seconds (i.e., the cell must be sampled at least once every 15 seconds).
2. An excursion is defined as a temporary variance beyond the average temperature tolerance, but not past the maximum

tolerance, of less than three minutes in duration. All excursions must be included in the calculation of the average temperature.

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2. The vehicle shall be force-cooled<sup>1</sup> to nominal test temperature (+3 F) in the test cell. Such force-cooling may only be accomplished using test cell air augmented by fans placed for maximum vehicle and engine cooling, not primarily oil pan cooling.
3. Vehicle temperature shall be determined using an oil temperature which is representative of the bulk oil temperature (i.e., measured near the middle of the oil, not at the surface or at the bottom of the oil pan).
4. After the force-cooldown, the vehicle shall be stabilized in the test cell for one hour before the start of the emissions test. The average temperature (dry bulb) during this hour shall be maintained within +5 F of the nominal test temperature with maximum excursions of +10 F from nominal test temperature.<sup>2</sup>

### III. Vehicle Emissions Test

#### A. Fuel Exchange and Heat Build

1. No fuel fill will be performed before testing.
2. No heat build will be performed before testing.

#### B. Dynamometer Warm-Up and Settings

1. The dynamometer shall be thoroughly warmed (while the test cell is cold) before testing.
2. A maximum of 5 minutes shall be allowed after the dynamometer is warmed to begin an emissions test. If the test is not started within 5 minutes, the dynamometer shall be rewarmed.
3. The dynamometer settings shall be the same for a cold temperature test as for a regular FTP.

1. Alternatively, the vehicle may be force-warmed if the vehicle has been soaked outside the test cell at tempera-

tures below test temperature. This could occur, for example, if the vehicle has been soaked outdoors during cold ambient temperatures.

2. Before the hour stabilization may begin, both the oil temperature must be within the +3 F tolerance and the vehicle placed in a test cell which is within +5 F of the nominal test temperature. Note that, as long as the oil temperature is within +3 F of the nominal test temperature, when this hour stabilization begins, it is not necessary to continue monitoring oil temperature.

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#### C. Test Specifics

1. If the vehicle is soaked in a different area and is brought through a warm area to the test cell, the vehicle must be stabilized in the test cell for one hour prior to testing. The average temperature (dry bulb) during this hour shall be maintained within +5 F of the nominal test temperature with maximum excursions of +10 F from nominal test temperature.
2. Cell temperature shall be stabilized at test temperature (+3 F) before the start of the test.
3. All accessories shall be in the "off" position during an emissions test, including the heater.
4. During each bag of the emissions test, cell temperature shall be maintained at an average temperature within +5 F of the nominal test temperature, with maximum excursions of +10 F from nominal test temperature.
5. Cell temperature shall be measured at the intake of the fixed speed cooling fan.
6. Hood position shall be in the "up" position.
7. Cooling shall be accomplished by a standard cooling fan (5,300 cfm), located as specified for the FTP.
8. Humidity in the room shall be set low enough to prevent condensation.
9. Tire temperature shall be at cell temperature before tire pressure is measured. (It can be assumed that tire temperature is at cell temperature if vehicle has completed either alternative defined under "Vehicle Soak.") Tire pressure shall be measured just preceding the

emissions test; the tires inflated to 45 psi.

D. Sample Collection

The sample collection system shall be designed and operated such that no condensation occurs. The system includes the pipe leading to the CVS (or CFV), the CVS (or CFV), the bag fill lines, the bags, and anything else in the system on which vehicle exhaust condensation may occur.

IV. Dynamometer Calibrations

Dynamometer calibrations shall be performed in accordance with existing procedures.

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ENCLOSURE II

Allowable Cold Temperature Test Procedure  
Variances for MVEL

NOTE: The letters and numbers listed below correspond to the sections of same identification on the draft proposal under "Test Procedure Specifications" in Enclosure I.

I. Vehicle Preparation

A. Fuel Exchange -All items shall be followed.

B. LA-4 Prep

1. a. The vehicle shall be placed in the cold test cell with the coldest fuel available and soaked for as much time as available, up to one hour, prior to the prep. If time is not available, the soak period may be waived. It is preferred to waive this soak period than to reduce any of the soak procedures after the prep.
2. The target cell temperature (dry bulb) before the start of the prep cycle is nominal test temperature (+3 F). However, allowances to +10 F, if necessary, will be acceptable.
3. During the prep cycle, the cell temperature shall

be maintained as closely as possible to nominal test temperature. However, prep cell temperature will not be a criteria to void a test.

4. Because of feedback of warmed engine air through the fixed speed cooling fan, the cell temperature may be measured on the axial fan (not currently being used). The thermocouple is located on the fan approximately three to four feet off the floor.

## II. Vehicle Soak (either of the following soaks may be used)

### A. Standard Vehicle Soak

1. The clock for the soak may be started immediately following the prep, even if the cell temperature needs to be lowered (but, from no more than +10 F from nominal test temperature). The +5 F average temperature tolerance does not apply to the first hour of the soak, as long as the cell is being operated at maximum cooling capacity.

### B. Modified Vehicle Soak

1. Soak temperature may not need to be controlled the last hour for one full hour. (See II.B.4 and III.C.1 for details.)
2. More than one fan may be used to augment cooling. These fans may be placed directly facing the front of the vehicle or directed from the sides of the vehicle toward the rear axle (if applicable). The

vehicle may be jacked up and the fans placed toward the oil pan, as long as cooling air is not directed exclusively at the oil pan. Cooling from the top of the engine with the hood up will also be allowed. Any procedure not included here to augment cooling must be approved in advance before it can be used.

4. The vehicle should be stabilized in the test cell for one full hour before the start of the emissions test, if possible. If not, the vehicle must be soaked for a minimum of one-half hour at the tolerances described if the vehicle is force-cooled. (See III.C.1. if the vehicle is soaked or force-cooled in an area other than the test cell.)

## III. Vehicle Emissions Test

### A. Fuel Exchange and Heat Build -No changes



B. Dynamometer Warm-Up and Settings

1. The dynamometer must be thoroughly warmed in the E&D cold room, but dynamometer warming is waived for EOD test site 004.
2. A time longer than 5 minutes may be allowed after the dynamometer is warmed to begin the emissions test, but shall be held to a maximum of 20 minutes.

C. Test Specifics

1. If the vehicle is soaked in a different area and is brought through a warm area to the test cell, the preferred stabilization period is one hour prior to testing. However, instead of the hour stabilization period, the oil temperature of the vehicle may be checked after it is placed in the cold room. If the oil temperature of the vehicle is within +3 F of nominal test temperature, the vehicle shall be stabilized for a minimum of three times the time it took to get the vehicle to the test cell before testing. If the oil temperature is not within +3 F, the vehicle must be stabilized for at least one-half hour. If the oil temperature is not within +5 F, the vehicle must be soaked until the oil temperature is within +3 F of nominal test temperature.
4. The temperature tolerances should be adhered to as closely as possible during the test, but are not required.
5. Because of feedback of warmed engine air through the fixed speed cooling fan, the cell temperature may be measured on the axial fan (not currently being used). The thermocouple is located on the fan approximately three to four feet off the floor.